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Miesner, Anna Katharina; Payne, Mark

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Forecasting the spawning distribution of blue whiting (*Micromesistius poutassou*)

Anna K. Miesner^{1†} and Mark R. Payne¹

Migratory fish species depend on cues from the physical environment to lead them to their spawning grounds. Since the marine environment is highly variable, this reliance on physical cues can lead to substantial shifts in spawning distributions between years, creating problems for both the monitoring and management of these populations. Previous studies have shown that changes in the spatial distribution of spawning of blue whiting (*Micromesistius poutassou*) are associated with changes in the North Atlantic sub-polar gyre; however, understanding of the underlying mechanisms at the local and individual level is limited and the predictive potential of this observation has not been exploited. We first use larval observations from the Continuous Plankton Recorder (CPR) from 1951-2005 to develop a statistical model of the preferred spawning habitat of this species, accounting for both migration processes and interannually-varying environmental conditions, both of which are shown to be important. The model shows agreement with independent data sources, including scientific surveys, and good predictive skill in out-of-sample cross validation tests. The slow dynamics of the environment in the spawning region lend themselves to the use of persistence forecasts based on observations (with a lag), and we quantify the potential forecast horizon using this approach. We then extend this horizon further by coupling the spawning-distribution model to a decadal forecasting system, and quantifying the skill in this region. Finally, the application of this knowledge to design surveys and improve management of this stock will be discussed.

Keywords: environmental niche model/species distribution model, blue whiting, spawning distribution, forecasting, survey-design

¹ Centre for Ocean Life, National Institute of Aquatic Resources (DTU-Aqua), Technical University of Denmark, 2920 Charlottenlund, Denmark.

[†] **Corresponding author.** Address: National Institute of Aquatic Resources (DTU-Aqua), Technical University of Denmark, 2920 Charlottenlund, Denmark. Tel.: +45 3396 3455. E-mail address: amie@aqua.dtu.dk